Pacific Herring Stocks and Fisheries in the Eastern Bering Sea, Alaska, 1981.

A Report to the Alaska Board of Fisheries
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ABSTRACT

A total of 17,652 m.t. of Pacific herring and 207.1 m.t. of spawn on kelp were harvested in eastern Bering Sea Commercial Fishing Districts during 1981. This was the second highest Pacific herring harvest and the highest spawn on kelp harvest recorded since these fisheries began in the 1960's. Estimated total value of harvests to fishermen was $6.2 million. Subsistence fishermen representing 138 families from Yukon-Kuskokwim delta villages harvested an estimated 70 m.t. of herring. Average roe recovery from commercially harvested herring was 8.9%. Approximately 10% of the total estimated herring biomass of 182,500 m.t. was harvested. Age 4 herring (1977 year class) comprised 50% of the total run and 46% of the total catch. Season openings in Togiak, Security Cove and Goodnews Bay Districts were regulated through Emergency Orders during 1981. This provided for an orderly fishery, high roe content recovery, and minimal wastage. It also ensured a normal onshore migration of herring, resulting in extensive spawn deposition, and allowed the Department to make periodic reassessments of the resource. Due to the large recruitment of young herring, the Department anticipates harvestable surpluses of herring to be available in all Districts in 1982. Management strategies for 1982 will be similar to those followed in 1981. However, the Department is requesting that Cape Romanzof District also be opened through Emergency Order.

INTRODUCTION

A total of 17,652 m.t. of Pacific herring and 207.1 m.t. of spawn on kelp were harvested in eastern Bering Sea commercial fishing districts during 1981 (Table 1, Figure 1). This was the second highest Pacific herring harvest and the highest spawn on kelp harvest recorded since these fisheries began in the 1960's. Estimated value of total harvests to fishermen was $6.2 million (Table 2). Wastage of herring was low; only 50 m.t. were estimated to have been lost or dumped during the season. Spawn on kelp wastage was estimated to have been 5 m.t. Numbers of buyers increased slightly in most areas (Table 3). Numbers of fishing vessels decreased in Togiak and Security Cove, but increased in all other districts. Average roe recovery from harvested herring ranged from 7.7 in Goodnews Bay to 9.1 in Togiak District (Table 2). Percent harvest of estimated herring biomass ranged from 7.9 in Togiak to 17.3 in Norton Sound District. Subsistence fishermen representing 138 families from Yukon-Kuskokwim delta villages harvested an estimated 70 m.t. of herring (Table 4). An overall increase in herring abundance was documented in all Districts (182,500 m.t. total biomass) due to recruitment of large numbers of age four herring (Table 5, Figure 2).

The purpose of this report is to provide results from 1981 stock assessment programs, review and evaluate 1981 harvests and management strategies for all commercial fishing districts and the Yukon-Kuskokwim delta subsistence fishery, and present management strategies for the 1982 herring fishing season.

SEASON SUMMARY

Stock Status

Assessment Methods

Aerial surveys were flown throughout the herring spawning season in all fishing districts, except Cape Romanzof, to determine relative abundance, distribution and biomass of herring schools. Occurrence and extent of milt, numbers of fishing vessels, and visibility factors affecting survey quality were also recorded. Data collection methods were similar to those used since 1978. A total of 204 hr was spent in aerial surveys: 107 hr in Togiak (including 11 hr of helicopter flying time), 32 hr in Security Cove/Goodnews Bay, 5 hr in Nelson/Nunivak Island area, and 60 hr in Norton Sound. This represented the most intensive aerial coverage ever achieved. Weather and sea conditions were generally better than in past years. However, storms and turbid water did hamper survey coverage during portions of the season in most districts.

Contracted purse seine vessels have provided data on tonnage per unit surface area for 12 herring schools within Togiak District (Table 6). This information provided further support to the hypothesis that herring school biomass (m.t./unit surface area) decreases as water depth decreases. Conversion factors of 1.2 (water depth 3m or less), 2.2 (water depth greater than 3m) and 3.1 m.t./50 m^2 (water depth greater than 8m) were used for post-season analysis of Togiak District data. Conversion factors of 2.4 or

3.4 m.t./50 m^2 were used for all other districts.

Test fishing with variable mesh gillnets and sampling of commercial landings were conducted in all fishing districts to determine age, size and sexual maturity of herring and to estimate occurrence and abundance of other schooling fishes. This information was used during post-season analyses to interpret and modify aerial survey data. A limited number of ground surveys were conducted in most districts to obtain information on the extent and density of herring spawn on kelp. Studies on growth, mortality and revegetation rates of Fucus sp. (rockweed) were initiated by investigators from University of Alaska, Juneau, under a contract with ADF&G. These studies, being conducted at sites within Togiak District, will also provide information to develop better methods for assessment of kelp standing crop and herring spawn deposition.

Spawning Populations

Togiak District

A total of 42 aerial surveys were flown on 30 days during the 1981 season, from 20 April to 3 June. Twenty-four of these surveys were made under fair to excellent conditions. Storm conditions during the period 28 April to 3 May prevented accurate assessment of herring arriving on the spawning grounds until most older herring had already spawned.

Test fishing with variable mesh gillnets was conducted from 21 April to 8

June. A total of 3,700 herring were sampled from these catches. Herring comprised 94% of the total catch of pelagic schooling fishes.

During the season, herring biomass was estimated to be between 134,400 and 160,300 m.t. Analysis of data from test fishing and contracted purse seine catches resulted in a post-season herring biomass estimate of 143,900 m.t. Approximately 48% of the total biomass was composed of age 4 herring (1977 year class)(Figure 2). Age 7 and 8 herring (1974 and 1973 year classes) accounted for most of the remaining biomass, 25 and 15%, respectively. Temporal changes in age composition of test fishing herring catches showed that older herring (age 5 and greater) arrived on the spawning grounds in peak numbers earlier in the season (3 May) than younger (age 4 and less), newly recruited, herring (15 May). This pattern had previously been documented in 1979 and 1980. Spawn deposition appeared to be extensive. A total of 64 linear km. of milt was recorded during aerial surveys. Two occurrences of subtidal spawning were documented for the first time.

Security Cove District

A total of 25 aerial surveys were flown on 22 days during the 1981 season, from 20 April until 2 June. Only five surveys were made under fair to good conditions. Poor weather and water turbidity in this Fishing District, as well as more northerly ones, continue to make herring biomass assessment difficult.

Test fishing was conducted from 28 April until 4 June. A total of 1,509

herring were sampled from these catches. Herring comprised 84% of the total catch of schooling fishes. However, most other schooling species were caught after herring had reached peak abundance.

During the season, herring biomass was estimated to be 7,100 mt. Post-season analyses resulted in a revised estimate of 7,500 m.t. Approximately 70% of the total biomass was composed of age 4 herring (Figure 2). No other strong age classes were evident. Peak abundance of herring occurred 14 May. A total of 16 linear km. of milt were recorded during aerial and ground surveys.

Goodnews Bay District

A total of 16 aerial surveys were flown on 16 days during the 1981 season, from 20 April to 2 June. Only five surveys were made under fair to good conditions.

Test fishing was conducted from 2 to 30 May. A total of 957 herring were sampled from these catches. Herring comprised 85% of the total catch of schooling fishes. Boreal smelt comprised 20% of the total catch during the time herring were reaching peak abundance.

During the season, herring biomass was estimated to be 4,000 m.t. Post-season analyses resulted in a revised estimate of 3,900 m.t. Approximately 62% of the total biomass was composed of age 4 herring (Figure 2). No other strong age classes were evident. Peak abundance of herring occurred 14 May. Two small milt patches were observed during aerial surveys, the first recorded

occurrence since surveying began in 1978.

Nelson and Nunivak Island Area

Aerial surveys were flown on three days during the 1981 season, from 7 to 17 May. Survey conditions were generally fair.

Test fishing was conducted from 10 to 23 May in the Nelson Island area. A total of 876 herring were sampled from these catches. Herring comprised over 99% of the total catch of schooling fishes.

During the season, herring biomass was estimated to be 3,600 and 17 m.t. in Nelson Island and Nunivak Island areas, respectively. No post-season adjustments were made to these figures. Age 4 and 7 herring comprised 27 and 29% of the biomass, respectively, occurring in the Nelson Island area (Figure 2). Age 9 and older herring together comprised 21% of the total biomass. A total of 2.4 linear km. of milt was recorded during the final aerial survey of Nelson Island. Small milt patches were observed during both Nunivak Island surveys.

Cape Romanzof District

Aerial surveys were not flown in this district due to poor water visibility.

Test fishing was conducted from 13 May to 7 June. A total of 701 herring were sampled from these catches. Herring comprised 93% of the total catch of

schooling fishes.

Although no aerial surveys were made, test fishing and spawn deposition study results indicated that herring were more abundant than during previous years. Therefore, a biomass estimate of 4,400 m.t. was adopted, based upon the assumption that the commercial harvest represented 15% of total available biomass. Age 4 herring comprised 45% of the sampled population (Figure 2). Age 5 and 7 herring comprised 13 and 15% of the population, respectively. In general, spawn deposition appeared more extensive and heavier than in past years.

Norton Sound District

A total of 22 aerial surveys were flown on 17 days during the 1981 season, from 8 May to 8 June. Survey conditions were better than those experienced during 1980. However, water visibility in Subdistrict 2 was generally unsatisfactory to poor all season.

Test fishing was conducted from 10 May to 15 June. A total of 3,594 herring were sampled from these catches. Herring comprised 97% of the total catch of schooling fishes.

During the season herring biomass was estimated to be 22,000 m.t. Post-season analyses resulted in a revised estimate of 22,800 m.t. Approximately 57% of the total biomass was composed of age 4 herring (Figure 2). Age 5 and 7 herring comprised 15 and 16% of the total biomass, respectively. Peak

abundance of herring occurred 26 May. A total of 21 linear km. of milt was recorded during aerial surveys.

SUBSISTENCE FISHERY

Subsistence fishing for herring is generally most important in villages on the Yukon-Kuskokwim River delta. Annual subsistence harvests in the eastern Bering Sea average approximately 100 m.t. (Table 4). About 75% of the total annual harvest is taken in the Nelson Island area at the villages of Tununak, Toksook Bay and Umkumiut (Nightmute). In 1981 a total of 58 m.t. of herring were harvested by 93 families in these villages. Catches at Toksook Bay were below average, due to an earlier than average herring spawning run. Three other villages on the Yukon-Kuskokwim delta, Scammon Bay, Hooper Bay and Chevak, were also surveyed in 1981. Total harvest was 12 m.t. by 45 families. Subsistence fishing effort in these three villages decreased in 1981 since several fishermen entered the commercial fishery in Cape Romanzof District. Although subsistence survey results are believed to accurately reflect harvest trends, reported catches represent minimum figures since all fishermen cannot be contacted.

COMMERCIAL FISHERY

Togiak District

Commercial herring fishing was regulated by Emergency Orders in 1981 to eliminate wastage problems and achieve exploitation rate objectives. Six

commercial openings were allowed during 2 to 12 May (total fishing time 101 hrs), resulting in a total harvest of 11,374 m.t. (Table 2). Most of the harvest was taken for sac roe; 16 m.t. were taken for food or bait. Purse seine vessels accounted for 82% of the total harvest; gillnet vessels accounted for 18%. Average roe recovery for the season was 9.1%. Average roe recovery from purse seine catches was 10.1%; average recovery from gillnet catches was 6.7%. Several processors commented that roe quality and recovery was higher than in previous seasons. The 1981 herring harvest was the second highest in the history of Togiak District and the second highest reported in the State for 1981. Wastage of herring was estimated at less than 30 tons, far below that which occurred in 1980 (5,200 m.t.). Value of harvested herring to fishermen was estimated to have been $4.0 million. Average price was $350 per s.t. for 10% roe recovery, with an increase or decrease of $35 per s.t. for each percentage point above or below 10%. Numbers of processors increased slightly over 1980 with 30 companies registering and 28 actually purchasing herring (Table 3). Numbers of fishing vessels decreased markedly. Only 83 purse seine and 106 gillnet vessels participated in 1981, a decease of 70% and 40%, respectively, from 1980.

Spawn on kelp harvests were also regulated by Emergency Order, in accordance with a plan adopted by the Board of Fisheries in 1979. Nine commercial openings were allowed, resulting in a total harvest of 171.9 m.t. Harvests in individual kelp management areas were allowed to reach 10% of the estimated total aquatic plant standing crop. Seven commercial processors purchased spawn on kelp from 108 fishermen. Value of the total harvest to fishermen was estimated to be $0.3 million. Average price was $0.66 per lb. The 1981 spawn

on kelp harvest was the second highest in the history of Togiak District. Less than 0.5 m.t. of spawn on kelp was lost during the 1981 season harvest.

Overall herring exploitation rate was 8% of estimated available biomass (Table 2). Harvest of younger, newly recruited, herring (age 4 and less) was 7%; harvest of older herring (age 5 and greater) was 9% (Figure 2). Older herring could have been harvested at a higher level, but storms and resulting water turbidity prevented accurate assessment of herring biomass arriving on the spawning grounds during 28 April to 3 May. The peak daily biomass estimate prior to 3 May was 7,000 m.t., well below the 20,000 m.t. threshold value set for allowing harvest of older herring. However, due to the extent and distribution of spawn, ADF&G staff felt that 13-18,000 m.t. of herring may have been present by 2 May. A 10 hr commercial test opening from 2 to 3 May resulted in a harvest of only 338 m.t. of herring. On the afternoon of 3 May a huge aggregation of herring (estimated biomass 58,300 m.t.) was observed in Togiak Section. Although a commercial fishing period was opened immediately that evening, these herring proved to be spawned out, old fish. Soon after this date young herring began arriving on the spawning grounds; most old herring had already spawned. Good visibility conditions generally persisted until just after the peak of young herring abundance was reached on 15 May. This allowed accurate assessments to be made so that harvests of these young herring were kept within Board of Fisheries guideline levels.

In general management of the 1981 commercial herring fishery greatly benefited by adoption of Emergency Order regulation procedures and Board of Fisheries harvest directives. Wastage was minimized, sac roe recovery and quality was

maximized, and catch reporting was timely and accurate. By channeling fishing effort into discrete periods a more normal onshore migration of herring was allowed, which resulted in more extensive, undisturbed spawning and enhanced ADF&G stock assessment capabilities. Increased mobility provided by a chartered helicopter and the ADF&G vessel R/V Sundance aided greatly in efforts to monitor and manage the fishery. This was particularly important since 49% of the harvest was taken in Hagemeister Section, the most westerly and remote area within Togiak District. Unavailability of a Fish and Wildlife Protection vessel limited the effectiveness of efforts to enforce regulations. Major concerns were gillnets remaining in the water and kelp harvests being made after period closures. Numerous oil slicks, due to bilge pumping by vessels within the large fleet, were sighted. This could have affected herring spawning success. Periods of bad weather, although generally limited during the 1981 season, continued to pose difficulties to stock assessments efforts.

Security Cove District

Commercial herring fishing was regulated by Emergency Order in 1981 to provide for a more orderly fishery and allow for periodic reassessment of herring biomass. Five commercial openings were allowed during 5 to 20 May (total fishing time 90 hrs), resulting in a total harvest of 1,064 m.t. (Table 2). Most of the harvest was taken for sac roe; 17 m.t. were taken for food or bait. Average roe recovery for the season was 8.1%. The 1981 herring harvest was the highest ever taken in this District. Value of harvested herring to fishermen was estimated to be $0.4 million. Average price was $400 per s.t.

for 10% roe recovery, with an increase or decrease of $50 per s.t. for each percentage point above or below 10%. Numbers of processors was similar to 1980; with 7 purchasing herring (Table 3). A total of 113 fishermen in 76 gillnet vessels participated in 1981, a decrease of 35% from 1980.

Overall exploitation rate of herring was 14% of estimated available biomass (Table 2). About 63% of the total commercial harvest were age 4 herring (Figure 2). Age 5 and 7 herring comprised 14 and 15% of the total harvest, respectively.

Management of the 1981 commercial herring fishery benefited by adoption of Emergency Order regulation procedures. However, violation of regulations was a problem. Major problems encountered were fishing after closures, fishing excessive gear, fishing in closed waters, fishing unmarked (or improperly marked) gear, fishing prior to the opening of periods, and failing to turn in fish tickets prior to leaving the District.

Goodnews Bay District

Commercial herring fishing was regulated by Emergency Order in 1981 to provide for a more orderly fishery and to better assess the herring stock. Nine commercial openings were allowed during 5 to 27 May (total fishing time 133 hrs), resulting in a total herring harvest of 596 m.t. (Table 2). Most of the harvest was taken for sac roe; 89 m.t. were taken for food or bait. Average roe recovery was 7.7%. The 1981 harvest was the highest ever taken in this District. Value of harvested herring to fishermen was estimated to be $0.2

million. Average price was $400 per s.t. for 10% roe recovery, with an increase or decrease of $50 per s.t. for every percentage point above or below 10%. Five processors purchased herring, one more than in 1980 (Table 3). A total of 175 fishermen in 104 gillnet vessels participated in 1981, a 6% increase from 1980.

Overall exploitation rate of herring was 15% of estimated available biomass (Table 2). About 76% of the total commercial harvest were age 4 herring (Figure 2). Age 5 herring comprised 12% of the total harvest.

Management of the 1981 commercial herring fishery benefitted by adoption of Emergency Order regulation procedures. Violations of various regulations occurred during the season, but were easy to observe due to the small size of this District. Common violations were fishing after a closure and fishing excessive fishing gear.

Cape Romanzof District

Commercial herring fishing opened by regulation 15 April, but fishing did not begin until 14 May when the first processor arrived. A temporary season closure occurred during 18 to 21 May to reassess herring stock condition and abundance. Occurrence of additional spawning and large ADF&G test fishing catches of maturing herring resulted in a short 6 hr commercial test fishing opening on 22 May. A final 24 hr period was allowed 25 to 26 May, since ADF&G test fishing catches during the previous May closure indicated a high abundance of herring. Total harvest for the season was 653 m.t. This was

higher than the harvest taken in 1980, the first year commercial fishing was allowed in this District. Value of harvested herring to fishermen was estimated to be $0.2 million. Average price was $400 per s.t. for 10% roe recovery with an increase or decrease of $50 per s.t. for each percentage point above or below 10%. Four processors purchased herring, double the number in 1980 (Table 3). A total of 111 fishermen in 82 gillnet vessels participated, an increase of 62% from 1980.

Overall exploitation rate of herring was estimated to be 15% of available biomass (Table 2). About 41% of the total commercial harvest were age 4 herring (Figure 2). Age 5 and 7 herring comprised 25 and 18% of the total harvest, respectively.

Management of the 1981 commercial herring fishery went smoothly and without serious incident. However, fishing with excessive amounts of gear, fishing during closures and under-reporting of catches were reported to have occurred in District outer waters. A large vessel and FWP staff are needed to prevent such violations in the future.

Norton Sound District

The commercial herring fishery opened by regulation on 15 April, but fishing did not begin until 18 May. Fishing was terminated under Emergency Order on 26 May in Subdistrict 1 (St. Michaels area), on 28 May in Subdistrict 2 (Unalakleet area) and on 28 May in Subdistrict 3 (Cape Denbigh area). Remaining Subdistricts were allowed to remain open until closed by regulation

31 July, since effort was low and harvest was less than 1 m.t. Total harvest for the District was 3,965 m.t., the highest ever taken (Table 2). Wastage was estimated to be about 20 m.t. Average sac roe recovery for the season was 8.8%. Value of harvested herring to the fishermen was $1.5 million. Average price was $400 per s.t. for 10% roe recovery, with an increase or decrease of $40 per s.t. for each percentage point above or below 10%. A total of 13 companies purchased herring from 332 fishermen (Table 3).

Spawn on kelp harvests were monitored to ensure that areas were not completely stripped of aquatic plants. The fishery opened by regulation on 15 April; the Black Point area was closed 27 May and the remainder of Norton Sound District was closed 29 May. A total of 42 m.t. of spawn on kelp was harvested. Four companies bought spawn on kelp from 22 fishermen. Value of the total harvest to fishermen was estimated to be $45,000. Average price was $0.58 per lb. Although the 1981 spawn on kelp harvest was the largest ever recorded in this District, 68% of the harvest was lost when a tender was swamped. Another 5 m.t. of the harvest was dumped since it was of poor quality and no buyers could be found.

Overall exploitation of herring was 17% of estimated available biomass (Table 2). About 38% of the total harvest was age 4 herring (Figure 2). Age 5 and 7 herring comprised 32 and 21% of the total harvest, respectively.

Management of the 1981 commercial herring fishery was without major problems. Initially, however, fishing effort was concentrated in Subdistrict 2 where turbid water made biomass assessment impossible. Therefore, this Subdistrict

was closed from 23 to 25 May to redistribute effort to Subdistricts with known harvestable amounts of herring, and to allow reassessment of Subdistrict 2 herring biomass. Several other closures and openings were needed in Subdistricts 1, 2 and 3 to ensure that harvests remained within directed levels. Presence of the ADF&G vessel M/V Sundance helped efforts to collect commercial catch samples. However, the M/V Sundance was unable to operate in the shallow waters of Stuart Island, in Subdistrict 1, where an estimated illegal catch of 150 m.t. of herring was reportedly taken. Fishing after closures and fishing excessive amounts of gear were commonly reported regulation infractions. Presence of a FWP plane along with a 6 m. Boston Whaler would be an effective means of enforcing regulations.

OUTLOOK AND MANAGEMENT STRATEGY FOR 1982

Togiak District

Based on the large recruitment of age 4 herring and significant returns of age 7 and 8 herring during 1981, the Department anticipates a harvestable surplus of herring will be available in 1982. However, since no methods are available to forecast actual returns (or to estimate recruitment) harvest levels will be adjusted during the season according to observed herring biomass. As was done last year, different management strategies will be applied to early run, older herring (age 5 and above) and late run, younger herring (age 4 and below). Magnitude and age composition of the run will be monitored during the spawning season through aerial surveys, test fishing, and commercial catch sampling. Emergency Order regulation authority will be used to adjust the occurrence and

length of fishing periods in relation to stock strength and spawning. No fishing will be allowed until older age herring reach a total daily observed biomass of 5,000 m.t. and spawning has started. This will allow a normal onshore migration, assure commencement of spawning, increase roe quality and content, and minimize waste. If it is not possible to determine herring abundance by using aerial surveys, stock condition will be assessed using commercial catch rates, roe recovery percentages, pre to post spawner ratios from test net and commercial catches, spawn deposition observations and 1980 aerial survey data. Harvest of these older herring will be 10 to 20% of estimated biomass. Spawn on kelp harvests will also be allowed in areas judged to have sufficient spawn deposition and adequate kelp standing crop. A more conservative approach will be taken in managing harvests of younger herring, as was done in 1980, since these herring are newly recruited to the spawning population and will contribute to future harvests and provide future spawning stock. A total daily observed biomass of 20,000 m.t. of younger age herring must be present before fishing is allowed. A graduated harvest rate of up to 20% of the biomass of these younger age herring will be harvested at that time. Additional spawn on kelp harvests may also be permitted during this period.

Security Cove District

Based on the 1981 herring spawning return and harvest, the Department anticipates a harvestable surplus of herring will be available in 1982. Since actual returns for 1982 cannot be estimated, harvest levels will be adjusted during the season according to results of aerial and ground surveys along with

Emergency Order authority. A minimum total daily biomass estimate of 800-1000 m.t. of herring will be required before fishing can begin. Attempts will be made to maintain an overall harvest of 10-20% of the available biomass. No major change in manangement strategy from 1981 is anticipated.

Goodnews Bay District

Management strategy for this district will be similar to that used for Security Cove: 1) Emergency Order regulation of season and periods, 2) minimum total daily biomass of 800-1000 m.t. prior to the season opening, and 3) 10-20% harvest of available biomass.

Cape Romanzof District

Although overall stock condition may be more favorable in this District than in those further south, since three age classes of herring were well represented (ages 4, 5 and 7), the herring population is comparatively small and the expanding fishery may be capable of taking the allowable harvest in a relatively short time. Therefore, the staff is proposing that fishing periods be regulated through Emergency Order to allow greater management control, better stock assessment, a more orderly fishery and adequate spawning.

Norton Sound District

As was found for Cape Romanzof herring, ages 4, 5 and 7 were well represented in 1981 test and commercial fishing catches. Furthermore, aerial survey data

compiled since 1978 has indicated a steady increase in herring abundance in Norton Sound District. Therefore, the 1982 herring harvest is expected to be similar to that in 1981. Major changes in management strategy are not anticipated. However, if effort significantly increases, frequent season closures may be required to maintain the harvest level at 10-20% of available biomass. Greater effort will be placed in monitoring the spawn on kelp harvest to avoid wastage problems and spread effort levels more evenly.

Table 1. Herring and herring spawn on kelp harvests in metric tons by U.S. commercial fishermen in the eastern Bering Sea, Alaska 1909 - 1981.

Year	Herring 1/						Herring spawn on kelp		
	Unalaska Island	Bristol Bay	Security Cove/ Goodnews Bay	Cape Romanzof	Norton Sound	Total	Bristol Bay	Norton Sound	Total
1909-1916					2/	2/			
1916-1928					1,705.6	1,705.6 3/			
1929	1,141.9				151.3	1,293.2			
1930	1,738.2				399.7	2,137.9			
1931	957.9				78.2	1,036.1			
1932	2,276.9				480.0	2,756.9			
1933	1,438.2				27.8	1,466.0			
1934	1,390.9				3.5	1,394.4			
1935	2,188.0				14.1	2,202.1			
1936	1,251.1					1,251.1			
1937	525.4				5.0	530.4			
1938	465.5				9.0	474.5			
1939					5.0	5.0			
1940					12.7	12.7			
1941					3.4	3.4			
1942-1944									
1945	68.0					68.0			
1946									
1947-1963		NO COMMERCIAL OPERATIONS REPORTED							
1964					18.1	18.1			
1965		NO COMMERCAIL OPERATIONS REPORTED							
1966					10.8	10.8			
1967		122.0				122.0			
1968		82.4				82.4	24.8		24.8
1969		42.8			2.0	44.8	4.6		4.6
1970		25.0			7.3	32.3	17.6		17.6
1971					17.7	17.7	23.5		23.5
1972		73.7			15.3	89.0	29.1		29.1
1973		46.3			32.3	78.6	5.3		5.3
1974		111.7			2.4	114.1	57.0		57.0
1975		50.4				50.4	50.4		50.4
1976					7.7	7.7	134.1		134.1
1977		2,534.9			9.5	2,545.4	125.1	trace	125.1
1978		7,030.4	259.0		13.6	7,303.0	149.6	3.4	153.0
1979		10,115.3	466.0		1,173.0	11,754.3	188.0	11.8	199.8
1980 5/		17,774.0 4/	1,039.0	554.0	2,215.4	21,600.3	86.0	22.2	108.2
1981 5/		11,374.3	1,660.2	653.2	3,964.5	17,652.2	171.9	37.2 6/	209.1

1/ Prior to 1964 majority of herring catch was taken in summer and fall for food market; since 1964 majority of herring catch was taken in spring primarily for marketing of roe.
2/ Fishery occurred some years, but harvests unavailable.
3/ Total catch for all years.
4/ There was an additional estimated 5,200 m.t. of wastage.
5/ Preliminary data.
6/ Does not include 5 m.t. dumped (unmarketable or no market when harvested).

Table 2. Estimated biomass and commercial harvest of Pacific herring in eastern Bering Sea fishing districts, Alaska, 1978-1981.

District	Biomass (m.t.)	Harvest (m.t.)	Roe %	Estimated Value (dollars)	% Biomass Harvested
			1981		
Togiak	143,900	11,374	9.1	3,988,000	7.9
Security Cove	7,500	1,064	8.1	347,070	14.2
Goodnews Bay	3,900	596	7.7	196,170	15.3
Cape Romanzof	4,400	653	8.0	211,260	15.0
Norton Sound	22,800	3,965	8.8	1,500,000	17.3
Totals	182,500	17,652	8.9	6,242,500	9.7
			1980		
Togiak	62,300	17,774[1/]	9.2	3,205,000	28.5[1/]
Security Cove	1,100	632	8.2	151,000	57.4
Goodnews Bay	1,100	406	9.5	97,000	36.9
Cape Romanzof	2,700	554	9.8	132,000	20.5
Norton Sound	7,600	2,224	8.1	500,500	29.3
Totals	74,800	21,590	8.8	4,085,500	28.9
			1979		
Togiak	216,800	10,115	8.6	6,700,000	4.7
Security Cove	19,500	385	8.5	327,000	2.0
Goodnews Bay	6,700	82	4.7	38,500	1.2
Cape Romanzof	2,700	0	-	-	0
Norton Sound	7,000	1,172	7.0	628,200	16.7
Totals	252,700	12,406	8.0	7,694,000	4.9
			1978		
Togiak	172,600	7,033	8.2	2,300,000	4.1
Security Cove	1,200	259	-	-	21.6
Goodnews Bay	400	0	-	-	0.0
Cape Romanzof	2,700	0	-	-	0.0
Norton Sound	4,800	13	-	-	0.3
Totals	181,700	7,305	8.2	2,300,000	4.0

1/ Does not include an estimated 5,200 m.t. of waste.

Table 3. Numbers of buyers and fishermen participating in eastern Bering Sea Pacific herring fisheries, Alaska, 1978-1981.

District	Number of Buyers	Number of Fishermen 1/	
		Gillnet	Purse Seine
		1981	
Togiak	28	106	83
Security Cove	7	113	**
Goodnews Bay	5	175	**
Cape Romanzof	4	111	**
Norton Sound	13	332	**
		1980	
Togiak	27	363	140
Security Cove	8	175	**
Goodnews Bay	4	165	**
Cape Romanzof	2	69	**
Norton Sound	8	294	**
		1979	
Togiak	33	350	175
Security Cove	2	61	**
Goodnews Bay	1	41	**
Cape Romanzof	No Fishery Conducted		
Norton Sound	7	50	17
		1978	
Togiak	16	40	25
Security Cove	3	-	-

** Purse seine gear prohibited

1/ Refers to # of vessels in Togiak District

Table 4. Subsistence herring catch (in metric tons) and effort data by selected areas, eastern Bering Sea, Alaska, 1975-1981. 1/

Village	1975	1976	1977	1978	1979	1980	1981
				Nelson Island			
Tununak	19.8	13.9	51.9	34.6	31.0	59.2	36.0
Umkumiut	30.0	8.5	2.8	10.4	7.5	3.1	9.0
Toksook Bay	31.0	31.8	19.3	33.5	46.5	26.6	13.0
Total	80.8	61.2	74.0	78.5	85.0	88.9	58.0
Number of fishing families	109	42	90	83	54	70	93
				Yukon-Kuskokwim Delta			
Scammon Bay	-	0.6	-	0.6	5.4	2.8	6.9
Chevak	-	0.6	0.1	-	2.1	3.2	1.7
Hooper Bay	2.5	2.7	2.1	3.5	2.8	3.3	3.6
Kwigillingok	-	9.6	0.9	-	7.2	12.0	-
Total	2.5	13.5	3.1	4.1	17.5	21.3	12.2
Number of fishing families	34	49	39	29	106	80	45
				Areas Combined			
Total Catch	83.3	74.7	77.1	82.6	102.5	110.2	70.2
Number of fishing families	143	91	129	112	160	150	138

1/ Other areas with small catches have been surveyed irregularly (1975-1978 estimated total coastal yearly subsistence catch averaged 100 m.t.).

Table 5. Relative abundance index (RAI) and estimated biomass of eastern Bering Sea herring, Alaska, 1978-1981.

District	Relative abundance index (RAI) [1] 1978	1979	1980	1981
Togiak	43,050	137,630	15,249	79,352
Security Cove	246	2,912	435	2,228
Goodnews Bay	241	3,729	[3]	1,593
Nelson Island	1,079	[3]	[3]	1,072
Cape Romanzof	539	[3]	[3]	[4]
Norton Sound	1,277	1,860	2,242	6,516
Totals	46,432	146,131+	17,926+	90,761+

District	Estimated biomass in mt [2] 1978	1979	1980	1981
Togiak	172,600	216,800	62,300	143,900
Security Cove	1,200	19,500	1,100	7,500
Goodnews Bay	400	6,700 [3]	1,100 [3]	3,900
Nelson Island	5,400	5,400 [3]	5,400 [3]	3,600
Cape Romanzof	2,700	2,700 [3]	2,700 [3]	4,400 [4]
Norton Sound	4,800	7,000	7,600	20,800
Totals	187,100	258,100	80,200	186,100

1/ Number of fish schools equivalent to 50 m^2 surface area, unadjusted for presence of non-herring pelagic species.

2/ Adjusted for presence of non-herring pelagic species. Estimates for 1978 and 1979 represent low end of estimate range's from Barton and Steinhoff (1980), 1980 estimates from Kingsbury (1980).

3/ Incomplete data due to inclement weather and/or turbid waters, biomass estimates are questionable and are based on 1978 and/or 1979 data.

4/ No aerial surveys made, estimate based upon assumption that commercial harvest represented 15 percent of total biomass.

Table 6. Conversion estimates (metric tons of Pacific herring per 50 m^2 school surface area) obtained from test purse seine fishing, Togiak District, Alaska, 1978-1981.

Year	Water Depth (m)	Biomass per RAI unit (m.t./50 m^2)	
1981	2	1.1	Catch landed
1980	3	1.2	Catch landed
1980	5	1.1	Catch landed
1980	5	1.2	Catch estimated in net
1979	6	2.4	Catch landed
1980	6	3.0	Catch estimated in net
1980	6	2.6	Catch estimated in net
1981	6	1.7	Catch landed
1980	8	1.6	Catch estimated in net
1981	8	4.0	Catch landed
1978	?	6.7	Catch estimated in net
1978	?	11.0	Catch estimated in net

Mean all estimates = 3.1
Mean estimates at 2-3 m = 1.2
Mean estimates at 5-8 m = 2.2

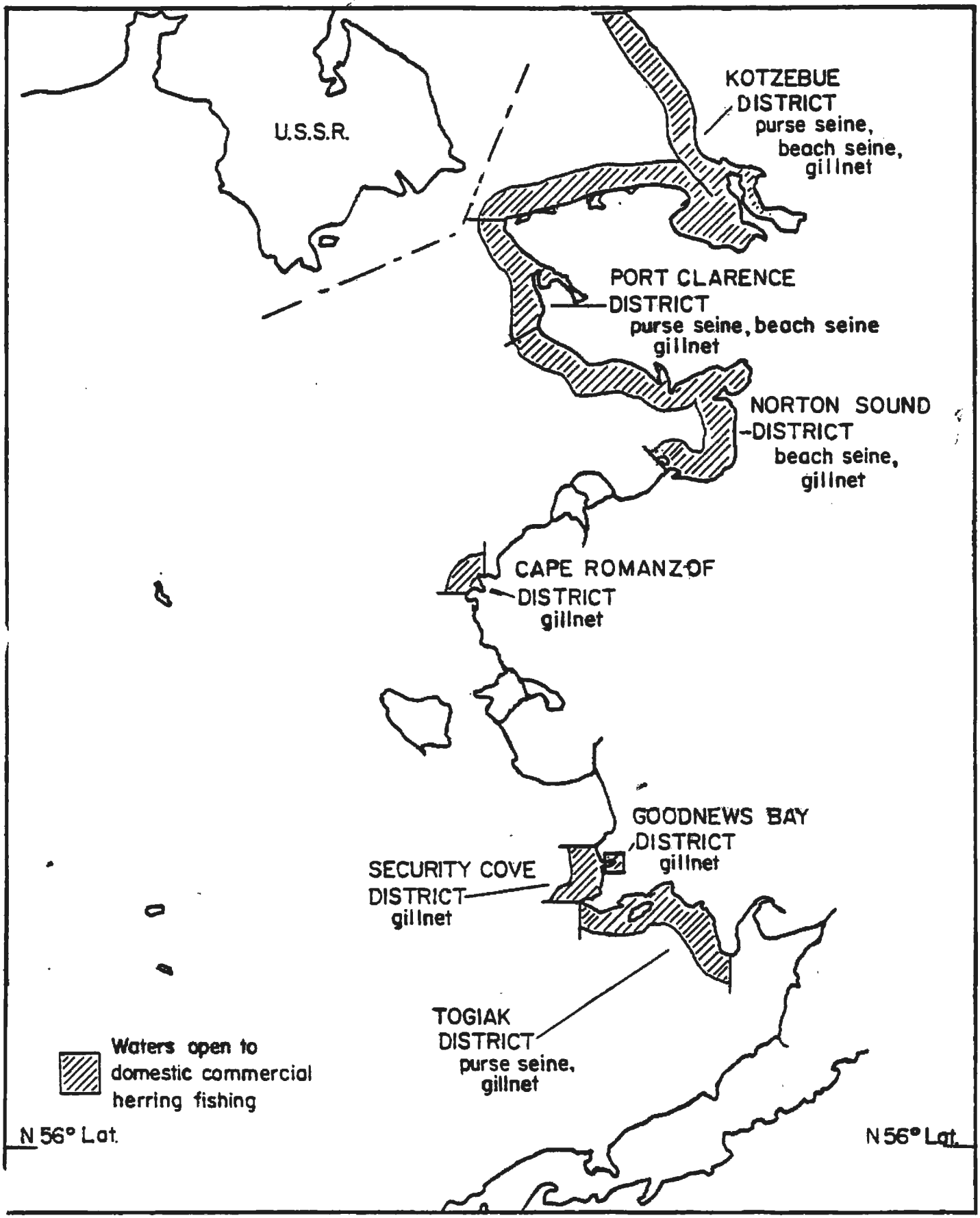

Figure 1. Commercial herring fishing districts and applicable gear, eastern Bering Sea Alaska, 1981.

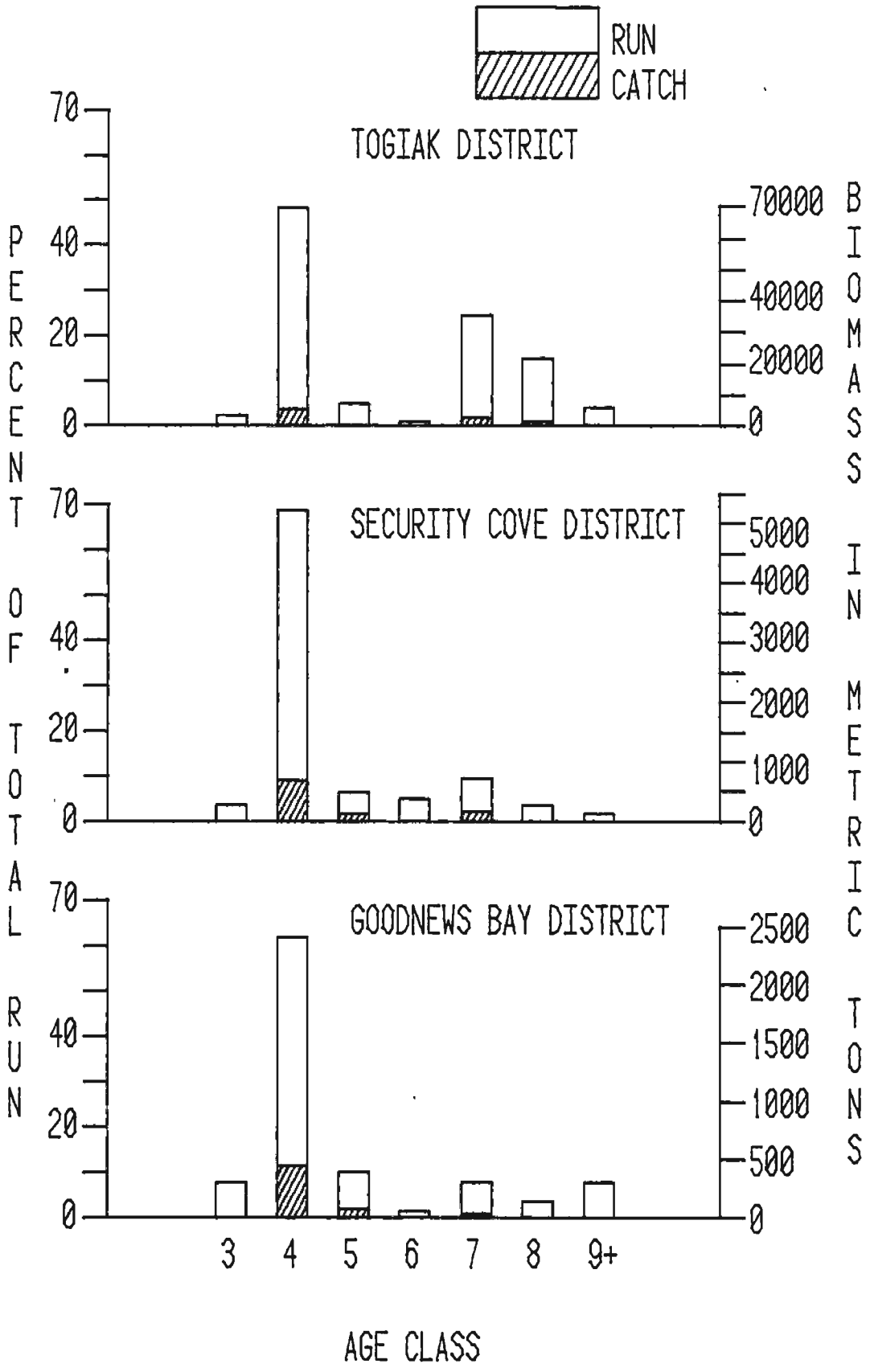

Figure 2. Age Composition of Pacific herring in spawning populations and commercial harvests in eastern Bering Sea, Alaska, 1981.

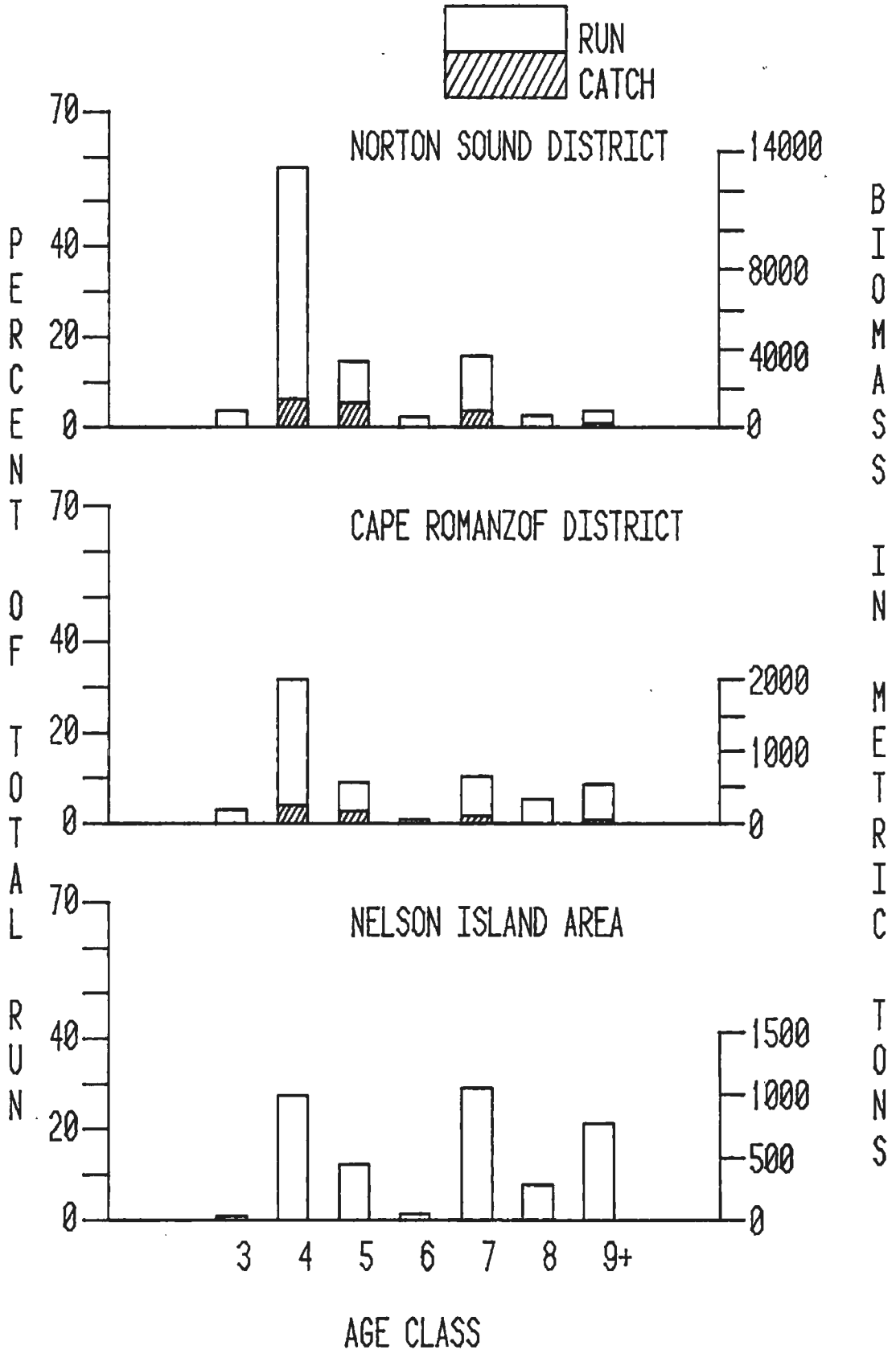

Figure 2. Continued.